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ered the society by the fellows of the Geological Society of Washington.

The annual banquet took place at the Hotel Raleigh on Wednesday evening. One hundred and thirty-seven covers were laid.

The following papers were either read by title or were presented while the undersigned were absent on the fourth day of the session.

On the whole the meeting of the society was most successful. The attendance was probably the largest in its history, and the warmest thanks are due the Washington members for their efforts in entertaining so large a gathering.

Structural Relations in the Piedmont Area of Northern Maryland: EDWARD B. MATHEWS, Baltimore, Md.

Recent Shoreline Changes, Nantucket: F. P. GULLIVER, Southboro, Mass.

Timber Lines: ISRAEL C. RUSSELL, Ann Arbor, Mich.

Recent Volcanic Craters in Idaho and Oregon: ISRAEL C. RUSSELL, Ann Arbor, Mich.

Lakes Malheur and Harney, Oregon: ISRAEL C. RUSSELL, Ann Arbor, Mich.

Artesian Wells Near Enterprise, Idaho: ISRAEL C. RUSSELL, Ann Arbor, Mich.

Concretions and their Geological Effects: J. E. TODD, Vermilion, S. D.

Ordovician Rocks of the Bellefontaine, Penn., Section: GEORGE L. COLLIE, New Haven, Conn.

The Cambrian and Pre-Cambrian of Hoosac Mts., Mass.: JOHN E. WOLFF, Cambridge, Mass.

The Relation Between the Keewatin and Laurentide Ice Sheets: A. H. ELFTMAN, Minneapolis, Minn.

Post Glacial Time: A. H. ELFTMAN, Minneapolis, Minn.

Glacial Boulders Along the Osage River in Missouri: C. R. BUCKLEY, S. H. BALL, A. T. SMITH, Rolla, Mo.

Glacial Drainage in Central-Western New York: H. L. FAIRCHILD, Rochester, N. Y.

J. F. KEMP,
A. W. GRABAU.

COLUMBIA UNIVERSITY.

ESTEVAN ANTONIO FUERTES.

ESTEVAN ANTONIO FUERTES died at Ithaca, N. Y., January 16, after a long illness which had, nevertheless, only recently put a period to his professional work and to his service as director of the College of Civil Engineering of Cornell University. He was still Professor of Astronomy, in charge of the A. C. Barnes Astronomical Observatory of the university, which institute he had happily lived long enough to see completely erected and equipped.

Dr. Fuertes was born in San Juan, Porto Rico, May 10, 1838, the son of Estevan Fuertes, for many years governor of the island, and his wife, Demetria Charbonnier. The family is ancient and distinguished. Its members have often been remarkable for talent and have held prominent positions under the Spanish crown for generations. He was educated in his native province (Ph.D.) and at the Rensselaer Polytechnic Institute at Troy, N. Y., graduating as civil engineer (C.E.).

Returning to his native city after leaving Troy, he became, first, Assistant Engineer of Public Works, then Director of Public Works, Western Division of Porto Rico (1861-3). In 1863 he was made assistant engineer, and later engineer, of the Croton Aqueduct Board of New York city (1863-9); from which position he retired when unable to withstand the embarrassments to which he was subjected by the corrupt elements of the then city government.

In 1870-1, he was the Chief Engineer of the U. S. Ship Canal Exploring Expedition to Tehuantepec and Nicaragua, under Admiral Shufeldt, conducting its engineering and geodetic work and writing a report of great value.

In 1871 he became a consulting engineer, and practiced his profession in and near New York until, in 1873, called to Cornell University to take direction of the department of civil engineering. In this position he spent the remainder of his professional life, and built his noblest monument in the erection of the present College of Civil Engineering and the establishment of its courses of instruction.

Commencing the work, in 1873, in two small rooms of an old wooden structure on the university campus, with an equipment which, as he reported, 'could be packed into a space of about thirty cubic feet,' under the guidance of its enthusiastic director, with the assistance of an able faculty, and with a student-body consisting of but a handful of pupils, the institution has grown until it now occupies forty-two rooms, and about two hundred and fifty students are inadequately accommodated in a large stone structure. Its faculty, exclusive of a dozen in the non-professional departments of the university and of a number of non-resident 'special lecturers,' numbers eighteen, and the resources of faculty and equipment are taxed to their utmost. The greatest of all the great enterprises recently planned and pushed to completion, under the supervision of the director of the college, is the adjunct hydraulic laboratory on the bank of Fall Creek, adjacent to the university grounds, commanding the drainage of 120 square miles of territory, equipped for measurement of every variety of hydraulic flow, and which has been employed since its construction in many researches under the direction of the college and for the state

and United States Executive Departments. His last, though a lesser undertaking, the A. C. Barnes Astronomical Observatory, was also the fruition of years of thought, study and careful designing.

The life of Mr. Fuertes closed with the completion of great enterprises; but his highest satisfaction was felt in the success of the young men sent out into professional work, well equipped and well trained. His reports in recent years have reiterated the statement that the demand for these young men was exceeding the supply and his last report included the assertion that but one of the regiment of alumni was known to be out of employment—a young man just returned from abroad. The record and the retrospect were exceedingly satisfying to the organizer and upbuilder of this great work when retiring from his almost life-long task.

While too busy to accept much outside work in his later years, one of his greatest and most useful tasks was accomplished quite recently—the project for the sanitary improvement of the city and harbor of Santos, Brazil. The plans for this work were as remarkable for their extent and completeness as was the work for its magnitude.

At the close of his course of professional study, Mr. Fuertes married Mary Stone Perry, of Troy, who survives him. He leaves five adult children, one of whom, Mr. James Hillhouse Fuertes, is already well known as a successful practitioner in engineering, and another, Mr. Louis Agassiz Fuertes, has won distinction as a follower in the steps of Audubon; all inherit something of the parents' talents.

Professor Fuertes was a man of strong individuality. Earnest and ambitious, sensitive and sympathetic, his warmth of heart and his easily touched sympathies admirably complemented his more vigorous faculties, and, in all the struggles and strifes of

professional and private life, those brought into contact with him found themselves, at the close of their however forceful relations with him, imbued with a kindly and affectionate sentiment, and often became warm and strong friends.

He was a member of many scientific, technical and professional associations, at home and abroad, and his death leaves a vacancy in many ways very difficult to fill, particularly, in the position which he for a generation held as an educator of the youth of his profession.

R. H. THURSTON.

SCIENTIFIC BOOKS.

Thermodynamics of Heat-engines. By SIDNEY A. REEVE, Professor of Steam Engineering at the Worcester Polytechnic Institute. New York and London, The Macmillan Company. 1903. 12mo. Pp. 304; figs. 58; steam tables, etc.

This little book, by the author of 'The Entropy-Temperature Analysis of Steam-Engine Efficiencies,' the first formal attempt to introduce this method of analysis to the student of the heat-engines in this country by a native writer, is particularly useful as elaborating that subject still more completely and helpfully. It, however, includes very much more than this. It is an interesting, original and instructive elementary treatise on the thermodynamics of the heat-engines, written by an author who has given, evidently, much patient and illuminating thought to the subject, and who has made himself thoroughly familiar with his work.

Every chapter gives proof of independent thought, and while, unquestionably, many of the modes of expression of fundamental ideas and facts would be differently presented and probably sometimes criticized by one trained in the forms of the great school of Clausiusian writers, every competent critic will probably admit the soundness of the philosophy and the clarity of expression which distinguish the book.

The start is excellent—a page of tabulated

notation—and the reader is permitted to begin his task by a comprehension of the language in which it is to be discussed. The symbols are all English. The general principles of energetics are elaborated and illustrated and viewed from various standpoints. The space taken is comparatively large; but the result is not only an understanding of, but familiarity with, the foundations of the science. The language of the 'laws' of energetics and of thermodynamics is sometimes paraphrased in multiple and with gain of understanding if not always in precision. The much-discussed 'Second Law of Thermodynamics' takes the form: 'The entropy of the world tends to a maximum and the temperature to a minimum.' It is, however, pointed out that the law may not hold with accuracy; 'since there is as yet no evidence accumulated which reveals any fixed proportion between the several sorts of energy in the universe,' and no such law can be stated, if it confines itself to a single form of energy, such as heat.

The cycles $p-v$ and $\theta-\phi$, are described, compared, their uses illustrated and, particularly, their individual characteristics and special utilities exhibited. The illustrative comparison with hydraulic energy-movements is very helpful. Of the new 'Third and Fourth Laws' of energetics and of thermodynamics, it may at least be said that the author states his points correctly. The new laws may not be accepted as formally entered on the statute-book by the scientific jury which always ultimately decides such matters.

In the study of steam- and gas-engines, the two graphical forms of illustration are employed, side by side, and very admirably, in exemplification of the principles and of the operations constituting the thermodynamic case. The reader of the work can hardly fail, if intelligent and thoughtful and a conscientious student, to secure a good idea of the most abstruse points of the subject and ability to make useful applications of the knowledge thus acquired.

The book is a valuable contribution to the literature of applied thermodynamics. The appended steam table is a distinctly important